

Do Active Canopy Sensors Measure Biomass or Chlorophyll in Corn?

Matthew Meade, Daniel Barker, and John E. Sawyer
Iowa State University, Department of Agronomy



INTRODUCTION

Vegetative indices from canopy sensors are currently being used as a tool to measure N deficiency in corn (*Zea Mays* L.). Symptoms of N deficiency include stunted growth (reduced biomass) and yellowing (reduced chlorophyll). It is unclear which sensor index is most useful.

The objective was to determine if canopy sensor indices (NDVI and CHL) measure plant biomass or plant chlorophyll.

MATERIALS & METHODS

A laboratory experiment was conducted measuring active sensor reflectance of albino and normal corn plants. The sensors were the NTech GreenSeeker Model 505 (GS505) and Holland Scientific Crop Circle ACS-210 (CC210).

Corn seeds from four hybrids were separated into six lots. Lots for each hybrid were planted in fourteen cups representing a sensing target of normal seedlings and albino seedlings, replicated three times. Seeds were soaked prior to planting for 12 hr in water (normal) and 50 mg L⁻¹ fluridone solution (albino). Plants were grown in the lab (under artificial light @ 25°C). Water was added frequently to keep soil moist.

After 21 d, cups were positioned (two cups wide by seven cups long) under each sensor at a distance of 50 cm. Readings were collected for 10 sec, with the average visible and near-infrared red reflectance used to calculate two vegetative indices (normalized difference vegetative index (NDVI) and chlorophyll index (CHL)).

After sensing, plants were collected for determination of dry matter (by treatment and hybrid).

Table 1. Means of sensor indices with albino and normal corn grown in the lab for 21 days.

Treatments	Sensor and Index			
	CC210		GS505	
	NDVI	CHL	NDVI	CHL
Albino				
P 0461XR	0.231	0.62	0.084	0.18
C 209-76R	0.185	0.45	0.090	0.20
A 6325	0.257	0.70	0.082	0.18
N 68B	0.201	0.51	0.080	0.18
Normal				
P 0461XR	0.493	1.97	0.449	1.75
C 209-76R	0.463	1.82	0.555	3.46
A 6325	0.461	1.74	0.374	1.20
N 68B	0.390	1.28	0.294	0.90
----- Stats. -----				
Plant Color	<0.01	<0.01	<0.01	0.02
Hybrid	0.41	0.27	0.35	0.47
Color*Hybrid	0.17	0.08	0.14	0.26

RESULTS

The CC210 and GS505 sensors produced similar index trends with albino and normal corn plants. Both sensor indices (NDVI and CHL) were reduced significantly with albino compared to normal plants (Table 1). There was no significant effect of hybrid and no color by hybrid interaction on sensor index values.

Figure 1 shows that albino plants and no corn plants had the same NDVI and CHL values. Normal corn showed no clear trend with dry matter, however albino corn produced the same index values regardless of dry matter.

CONCLUSIONS

In this experiment, plant color had the greatest influence on NDVI and CHL indices.

In albino corn, increasing dry matter did not result in an increase in sensor indices.

When determining N deficiency symptoms in corn, both NDVI and CHL indices appear to be most sensitive to estimation of plant chlorophyll.

ACKNOWLEDGEMENTS

This work was supported in part by the Science with Practice program for undergraduate students at Iowa State University.

REFERENCE

Maas, S.J., and J.R. Dunlap. 1989. Reflectance, transmittance, and absorbance of light by normal, etiolated, and albino corn leaves. *Agron. J.* 81:105-110.

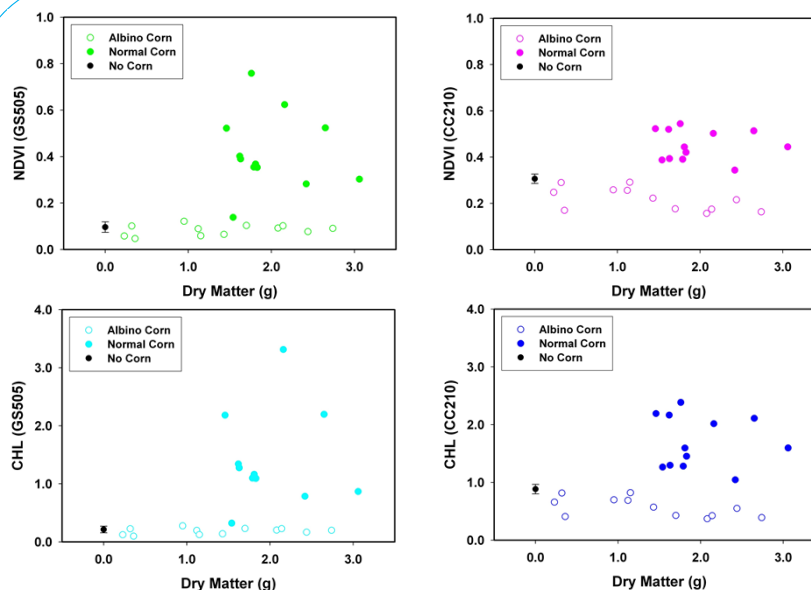


Fig. 1. Comparison of sensor indices with albino and normal corn